We claim:

1. A method of evaluating tolerances of computer assisted designs for the manufacture of objects comprising:

representing each tolerance zone for each geometric feature of said object by a model with an algebraic form and a geometric form as a tolerance map stored in a computer;

computing in said computer interdependencies between said stored maps and interdependencies between submaps of said stored maps to determine how different tolerance zones for said geometric feature affect each other and to determine how different tolerance zones for different geometric features of said object affect each other; and

selecting tolerance conditions for said object to optimize allocation of tolerances to each of said geometric features of said object.

2. The method of claim 1 where representing each tolerance zone for each geometric feature of said object comprises a tolerance map representing a plane.

3. The method of claim 1 where representing each tolerance zone for each geometric feature of said object comprises a tolerance map representing a axis or edge.

4. The method of claim 1 where representing each tolerance zone for each geometric feature of said object comprises a tolerance map representing a cylindrical surface.

5. The method of claim 1 where representing each tolerance zone for each geometric feature of said object comprises a tolerance map representing a position.

6. The method of claim 1 where representing each tolerance zone for each geometric feature of said object comprises a tolerance map representing composite tolerances constructed as a Minkowski sum.

7. The method of claim 1 where representing each tolerance zone for each geometric feature of said object comprises a tolerance map in a space of points of variational possibilities of features of said object.

8. The method of claim 1 where representing each tolerance zone for each geometric feature of said object comprises a tolerance map in a space of points of variational possibilities of features of said object.

9. The method of claim 2 where representing each tolerance zone for each geometric feature of said object comprises a tolerance map in a space of points of variational possibilities of features of said object expressed in Barycentric coordinates.

10. The method of claim 1 where computing in said computer interdependencies between said stored maps and interdependencies between submaps of said stored maps comprises superimposing on a tolerance zone of said geometric feature a tolerance zone specifying parallelism of variations of said geometric feature.

11. The method of claim 1 where computing in said computer interdependencies between said stored maps and interdependencies between submaps of said stored maps comprises superimposing on a tolerance zone of said geometric feature a tolerance zone specifying flatness of said geometric feature.

12. The method of claim 1 where computing in said computer interdependencies between said stored maps and interdependencies between submaps of said stored maps comprises generating a tolerance zone of an assembled geometric feature for a assembly of at least two objects, each of which objects has a corresponding tolerance zone for corresponding geometric features which are being assembled to comprise said assembled geometric feature.

13. The method of claim 4 where representing each tolerance zone for each geometric feature of said object comprises a tolerance map in a space of points of said object expressed in Pluecker coordinates.

14. The method of claim 3 where representing each tolerance zone for each geometric feature of said object comprises a tolerance map in a space of points of said object expressed in terms of line-solids.

15. The method of claim 4 where representing each tolerance zone for each geometric feature of said object comprises a tolerance map in a space of points of said object for size of cylindrical surfaces is expressed in terms of screw coordinates.

16. The method of claim 1 further comprising establishing a global model by mapping surfaces used as datum or targets in a dimensioning scheme to equivalent control frames in which datum reference frames are rigid sets and validated using degree of freedom algebraic operations, and by representing dimensions and tolerances by the union of corresponding control frames involving the datum and target rigid sets and corresponding tolerance classes.

17. The method of claim 16 wherein mapping surfaces used as datum or targets in a dimensioning scheme to equivalent control frames comprises forming datum reference frames as rigid sets for target features and feature patterns.

18. The method of claim 17 wherein mapping surfaces used as datum or targets in a dimensioning scheme to equivalent control frames in which datum reference frames are formed as rigid sets for a circular pattern of bolt holes.

19. The method of claim 16 further comprising identifying redundant or conflicting restraints by using a degree of freedom algebra on control frames by determining whether the corresponding datum reference frame is a rigid set and the maximum degrees of freedom which said datum reference frame controls.

20. An apparatus for geometric variations to integrate parametric CAD with tolerance analysis and optimization of a manufactured object comprising a computer wherein is stored:

a geometry engine module E1 to generate a B-rep solid model of said object;

a constraint solver E2 to generate a D&T graph of said object;

a geometry engine system M1 communicated to said geometry engine module E1 and constraint solver E2;

a dimensioning module M2 for receiving said B-rep solid model and said D&T graph as input data;

a tolerancing module M4 communicating with said dimensioning module M2;

a global visualization module M3 communicating with said tolerancing module M4;

a D&T Schema Advisor module M5 communicating with said tolerancing module M4;

a tolerance allocation module M6 communicating with said tolerancing module M4;

a local model visualization module M7 communicating with said tolerance allocation module M6 for providing a geometric visualization of tolerancing of said object; and

a statistical tolerance analysis package E3 communicating with said tolerance allocation module M6 for providing an algebraic visualization of tolerancing of said object.